

Data	Codeword
00	00000
01	01101
10	10111
11	11010

1. What is this code's efficiency?
2. Find the generator matrix  $G$  and parity-check matrix  $H$  for this code.
3. Give the decoding table for this code. How many patterns of 1, 2, and 3 errors are correctly decoded?
4. What is the block error probability (the probability of any number of errors occurring in the decoded codeword)?

**Problem 6.23:** Digital Communication

A digital source produces sequences of nine letters with the following probabilities.

letter	a	b	c	d	e	f	g	h	i
probability	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

- (a). Find a Huffman code that compresses this source. How does the resulting code compare with the best possible code?
- (b). A clever engineer proposes the following (6,3) code to correct errors after transmission through a digital channel.

$c_1 = d_1$	$c_4 = d_1 \oplus d_2 \oplus d_3$
$c_2 = d_2$	$c_5 = d_2 \oplus d_3$
$c_3 = d_3$	$c_6 = d_1$

What is the error correction capability of this code?

- (c). The channel's bit error probability is  $1/8$ . What kind of code should be used to transmit data over this channel?

**Problem 6.24:** Overly Designed Error Correction Codes

An Aggie engineer wants not only to have codewords for his data, but also to hide the information from Rice engineers (no fear of the UT engineers). He decides to represent 3-bit data with 6-bit codewords in which none of the data bits appear explicitly.